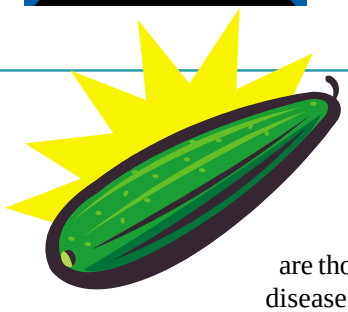
FORUM



Finding Foods That Agree With Our Genes

Since the recent announcement of completion of the rough draft of the sequence of the human genome, there has been much speculation about how this information will change our understanding of health and disease. This gene-mapping accomplishment, which started with the landmark discovery of DNA in 1953, raises many questions about the value of sequence data. After all, knowing the sequence of the genes in the body is interesting, but it doesn't tell us what the genes do.

DNA scientists are striving to relate the sequence data to gene function. This includes not only what the genes do, but also how they interact with each other and the environment to control our body's responses to changes in the environment and diet.

This knowledge will come about through functional genomics, the science of understanding the organization of genetic pathways and the expression of genes.

Genes produce mRNA, which directs synthesis of proteins. Studying cell type and the conditions under which specific genes are activated to produce a specific protein will lead to describing roles for genes in response to environmental and dietary stimuli. The modern study of the cellular function of proteins has been labeled "proteomics." Proteomics and functional genomics will become a larger part of the human nutrition program in ARS.

What does all of this have to do with foods we eat? A lot.

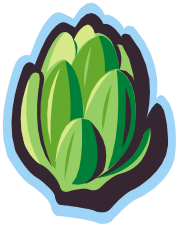
Certain variants of genes predispose us to respond to nutrients in a particular way. For example, some of us are predisposed to cardiovascular disease (see "Attacking Heart Disease at Its Genetic Base," *Agricultural Research*, July 1999, pp. 20-21) or chronic diseases, like obesity, certain cancers, cataracts, and diabetes.

Other people may have difficulty absorbing and using nutrients. The story on page 12 in this issue of *Agricultural Research* provides new evidence that given the exact same amount of a nutrient, each of our bodies might use the nutrient differently. In this study the nutrient administered was beta-carotene, and some people absorbed more of it than others and converted more of it to vitamin A.

In the first half of the 20th century, human nutrition research focused on studying nutritional deficiencies and inadequate diets. Later the emphasis switched to the role of phytochemicals and other nonclassical nutrients. Many of these phytochemicals are thought to prevent or reduce risk for certain chronic diseases. For those diseases strongly linked to diet, the costs for treatment and care exceed $200 billion per year.

One goal of future research will be to describe the role of particular genes that predispose people to diseases as a result of a specific food consumption pattern. Very little is known about how nutrient intakes, genotypes, and living environments interact to affect individual health. There are, however, known genetic defects that interfere with normal nutrient action, such as in Menkes' disease or Wilson's disease in which one has inadequate or excess copper absorption, respectively. But more needs to be discovered about other gene-nutrient interactions that play a key role in our health.

Today we're trying to refine the recommended dietary intakes (RDIs) for copper and other micronutrients to ensure that Americans of all ages get enough of these nutrients (see the article on page 8 of this issue). ARS scientists are among the prominent experts nationally who have been selected to help establish RDIs for these nutrients. Ideally, genetic factors that affect an individual's uptake and use of essential nutrients could be taken into account in RDIs of the future.



New and innovative genetic information will advance the science of human nutrition. This information will not only aid those who have known genetic defects, but will just as importantly help those with common variants of genes. One day, individuals may be able to tailor their diet to their genetic constitution to reduce the risk of chronic disease.

Our past and our future are in our genes. ARS human nutrition research will help us to extend our life and be healthier by identifying foods that agree with our genes.

Kathleen C. Ellwood
ARS National Program Leader
Human Nutrition
Beltsville, Maryland